

CLAIMS

What is claimed is:

1. A medical device comprising:
 - a sensor configured to measure a property of an outer layer of an anatomical body surface, the sensor including:
 - 5 a source probe configured to stimulate a local surface of the outer layer of an anatomical body surface,
 - a detector configured to measure a response of the outer layer resulting from the source probe to stimulation; and
 - 10 a controller coupled to the sensor, wherein the controller drives the source probe using a tailored stochastic sequence and determines the property of the outer layer using the measured response received from the detector.
2. The device of claim 1 wherein the properties are determined with system identification techniques.
- 15 3. The device of claim 2 wherein the body surface is modeled as a second order mechanical system.
4. The device of claim 1 wherein the body surface is an internal body surface.
5. The device of claim 1 wherein the body surface is the skin of a subject.
6. The device of claim 1 further comprising a servo-controller coupled to a delivery device for delivering a pharmaceutical, the servo-controller adjusting the delivery characteristics of the delivery device based on the surface properties.
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7. The device of claim 1 wherein the source probe comprises a voice coil.
8. The device of claim 1 wherein the detector comprises an accelerometer detecting displacement of the body surface.
9. The device of claim 1 wherein the detector comprises an linear differential variable transducer detecting displacement of the body surface.
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10. The device of claim 9 wherein the detector further comprises a strain gauge measuring a static displacement of the body surface.
11. The device of claim 1 further comprising a drug injection device coupled to the sensor, the drug injection device injecting a drug into an anatomical body in response to the determined property of the outer layer.
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12. The device of claim 11 wherein the drug injection device comprises a needleless injector.
13. A method for measuring properties of an outer layer of an anatomical body comprising:
15 placing a sensor against an outer layer of an anatomical body;
 stimulating the outer layer of an anatomical body with the sensor using a tailored stochastic sequence;
 measuring a response of the outer layer of an anatomical body to the stimulation; and
20 determining a property of the outer layer of an anatomical body based on the measured response to the tailored stochastic sequence stimulation.

14. The method of claim 13 wherein determining a property further comprises using system identification techniques.
15. The method of claim 14 further comprising modeling the outer layer of an anatomical body as a second order mechanical system.
- 5 16. The method of claim 13 further comprising adjusting the delivery profile of a delivery device for delivering a pharmaceutical.
17. The method of claim 16 wherein the delivery device is a drug injection device.
18. The method of claim 17 wherein the drug injection device is a needleless injection device.
- 10 19. The method of claim 16 wherein the adjusting is performed with a servo-controller based on the determined property.
20. The method of claim 16 wherein stimulating the outer layer of an anatomical body comprises placing a voice coil against the outer layer and driving the voice coil at a frequency.
- 15 21. The method of claim 16 wherein measuring a response of the outer layer of an anatomical body to the stimulation comprises measuring displacement of the outer layer.
22. An apparatus for injecting drug into a biological body comprising:
 - a drug injector for holding the drug to be delivered to the body;
 - 20 a skin sensor that measures skin properties of the body; and

a servo-controller coupled to the drug injector and the skin sensor, the servo-controller adjusting the injection pressure of the drug injector to selectively deliver the drug to the body based on the skin properties.

23. The apparatus of claim 22 wherein the skin sensor measures the properties of the body using a tailored stochastic sequence.
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24. A method for injecting drug into a biological body comprising:
holding a drug to be delivered to the body in a drug injector;
measuring skin properties of the body;
adjusting the injection pressure of the drug injector with a servo-
controller based on the skin properties; and
10 injecting the drug into the body.
25. The apparatus of claim 24 wherein the skin sensor measures the properties of the body using a tailored stochastic sequence.